



INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI  
SHORT ABSTRACT OF THESIS

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Programme of Study : Ph.D.

Thesis Title: Loan Portfolio Management in the Paradigm of Leveraged Risk, Liquidity Risk and Limited Liability

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Thesis Submitted to the Academic Division : Mathematics

Date of completion of Thesis Viva-Voce Exam : 25 November 2025

Key words for description of Thesis Work : Portfolio Optimization, Leverage Ratio, Liquidity Risk, Limited Liability, HJB Equation.

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**SHORT ABSTRACT**

In the context of a loan portfolio, banks and other financial institutions are subjected to Limited Liability protection. However, in most of the model formulation, this protection is not taken into consideration. Accordingly, in order to address this gap, we have focused on incorporation of Limited Liability in the model paradigm. We begin by considering four models, one for maximizing expected return and the other with minimization of risk (with a threshold of expected return), both for the scenarios of including and excluding Limited Liability. Our theoretical results show that the solutions of the models with Limited Liability produce better results than the others, in terms of both maximizing expected return and minimizing risk. More specifically, the portfolios that included Limited Liability are less risky as compared to the portfolios that did not include Limited Liability. An illustrative example is presented to support the theoretical results obtained.

In case of liquidity risk with Limited Liability protection, we construct a novel loan portfolio model with Limited Liability, while maintaining a threshold level of haircut in the portfolio. For the constructed three-time step loan portfolio, at the initial time, the bank raises capital via debt and equity, investing the same in several classes of loans, while at the final time, the bank either meets its liabilities or becomes insolvent. At the intermediate time step, a fraction of the deposits are withdrawn, resulting in liquidation of some of the bank's assets. We have proposed a liquidation strategy that minimizes liquidation cost and also reduces liquidation of the safe asset, thereby reducing the risk of default. Our theoretical results show that the model with the haircut constraint leads to lesser liquidity risk, as compared to the scenario of no haircut constraint being imposed. A numerical example then demonstrates these results.

Next, we consider the bank's dynamic decision problem in the intermediate time step for a discrete-time setup. We have considered a three-time-step model. Initially, the banks raise money through debt and equity and invest in different types of loans. It liquidates its assets and raises new funds at the intermediate-time step to meet the short-term debt holder's claim. Further, it has to meet specific capital requirements given by the regulators. We have theoretically studied the effect of raising new equity and debt. We show that in some cases, raising equity and debt may increase the return on equity, and in some cases, it may decrease the return on equity. We have discussed several cases and given a bound on the capital that can be raised. We have added an equity holder's constraint, which ensures the return on equity and desists the bank from defaulting at the final time point.

Finally, we have considered the portfolio optimization model with Limited Liability in a continuous time setup. We have shown that the model with Limited Liability incorporates less riskier assets. If the risk is low, the result with and without Limited Liability is the same. We then present a numerical example to illustrate this result.

